PURDUE UNIVERSITY FORT WAYNE | Department of Civil and Mechanical Engineering

Course	ME 47100 – Vibration Analysis
Type of Course	Elective (Group 1) for ME program
Catalog Description	Introduction to simple vibratory motions such as damped and undamped free and forced vibrations, resonance, vibratory systems with more than one degree of freedom, Coulomb and systeretic damping, transverse vibration of beams, torsional vibration, computation of natural frequencies and mode shapes, applications.
Credits	3
Contact Hours	3
Prerequisite Courses	ME 33100
Corequisite Courses	None
Prerequisites by Topics	Dynamics, Differential Equations, Linear Algebra
Textbook	W. T. Thomson and M. D. Dahleh, *Theory of Vibration with Applications*, Prentice-Hall, current edition.
Course Objectives	To introduce vibration analysis for single and multiple degrees of freedom systems: terminology, derivation of equations of motion, solution techniques using analytical and numerical methods.

Course Outcomes

A student who successfully fulfills the course requirements will be able to:

1. Model linear oscillatory systems through understanding and practicing of **(1, 7)**
   - fundamental mechanical system elements
   - mechanics laws and work and energy principle
   - simplifying/idealizing complex real world engineering problems
   - equations of motion for mechanical vibration systems
2. Analyze vibration responses of single DOF systems through understanding and practicing of **(1, 7)**
   - free vibration of undamped and damped systems
   - forced vibration analysis
   - resonance
   - transient response analysis

3. Analyze vibration responses of multiple DOF systems through understanding and practicing of **(1, 7)**
   - Eigenvalue problems
   - normal modes
   - modal coordinates
4. Analyze vibration responses of one-dimensional continuous systems **(1, 7)**
   - equations of motion for strings, bars, and beams
   - boundary value problems
   - transverse vibration of a string
   - longitudinal vibration of a bar
   - torsional vibration of a bar
   - transverse vibration of a beam
   - normal mode expansion method
5. Apply computer tools to solve complex vibration problems **(1, 3, 7)**
   - application of modern computing tools
   - technical report writing

Lecture Topics	1. Fundamentals of vibration
	2. Free vibration of 1-DOF systems
	3. Harmonically excited vibration of 1-DOF systems
	4. Transient vibration of 1-DOF systems
	5. Vibration of multi-DOF systems
	6. Vibration isolation
	7. Properties of vibrating systems
	8. Normal mode / modal analysis
	9. Vibration of continuous systems

Computer Usage   High

Laboratory Experience   None

Design Experience   Low

Coordinator   Bongsu Kang, Ph.D.

Date   14 December 2022